TEMPORARY REFUGEE SHELTER

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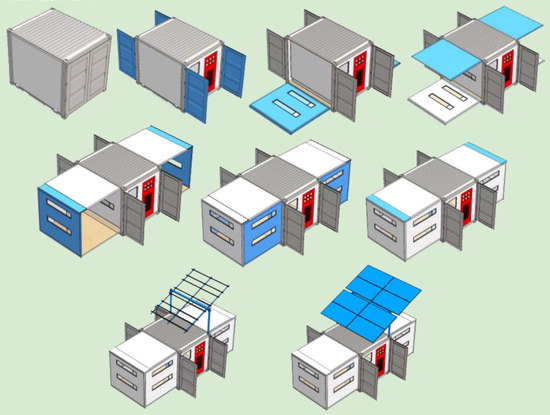
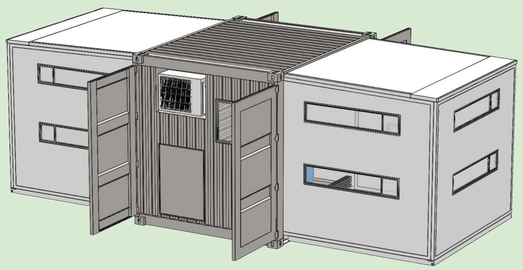
STRUCTURAL FOLDING SYSTEM

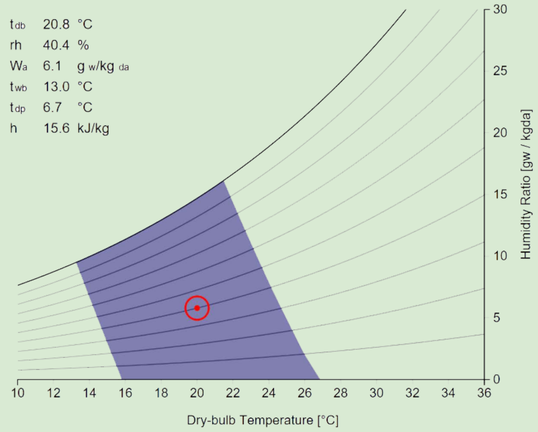
The designed shelter will utilize a specialized 10 foot shipping container that is typically used for domestic logistics. Maximizing the available occupiable space within the container will be accomplished by allowing the longer two sides of the container to unfold. With the two sides unfolded, the exterior walls and ceiling can then be assembled from the main foundation of the container.



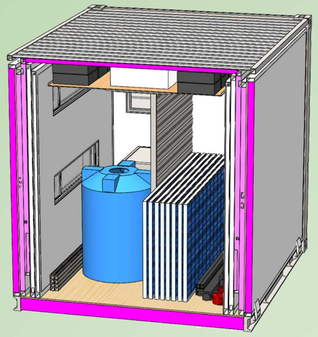
HVAC

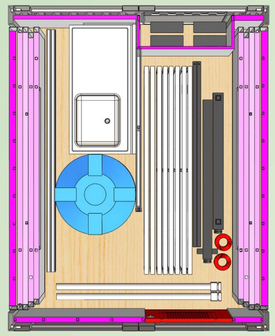
The HVAC system uses a heat pump mini-split for its high energy efficiency, electrical energy input, relatively low maintenance, and 12-15 year life expectancy. The Mitsubishi ductless air source heat pump combines heating and cooling for the shelter into one unit. The Eva-dry E-500 unit was selected for dehumidification of the shelter. The dehumidifier will work in conjunction with the mini split to ensure that comfortable humidity level is achieved. The image below shows the ventilation system in the back of the shelter.

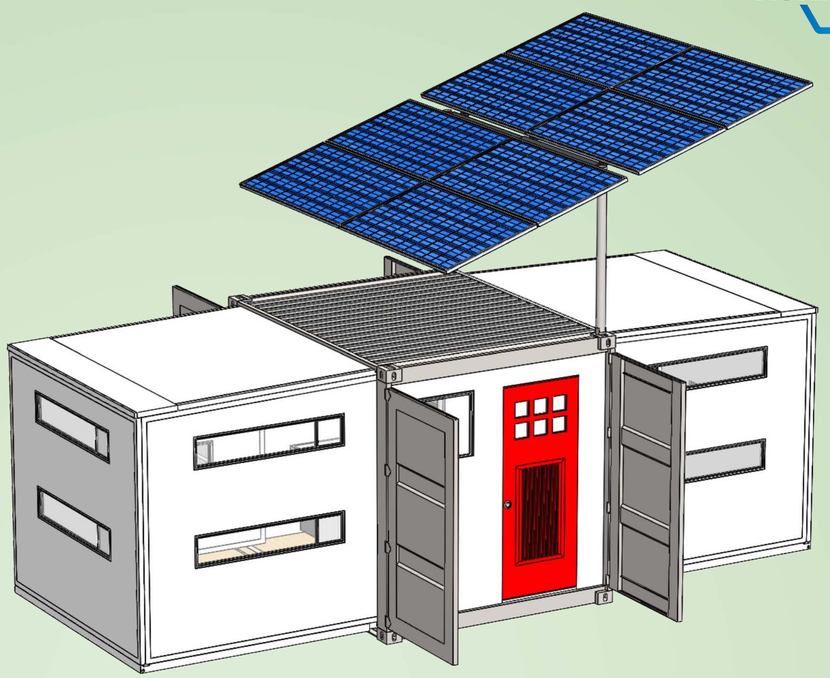




This psychometric chart shows ASHRAE standard 55 in blue, and the indoor environmental conditions of the shelter targeted in red.







ASHRAE 2018 DESIGN COMPETITION STANDARDS

- Must design for an Eastern European Location
- Must accommodate 6-8 people
- 260 ft^2 maximum footprint & 8.5 ft maximum height
- No access to municipal water or sewer
- Must provide all essential domestic systems
- Must meet ASHRAE standards for thermal comfort (standard 55), and ventilation (standard 62)

ASHRAE METRICS	Status
Maximum Footprint 260 ft^2	217 ft^2 ✓
Maximum Height 8.5 ft	8.5 ft ✓
Comply with ASHRAE Standard 55	Pass ✓
Comply with ASHRAE Standard 62	Pass ✓
Provide Essential Domestic Systems	Pass ✓

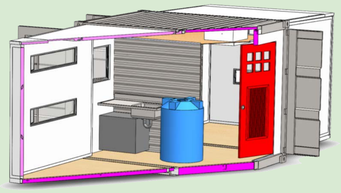
NON-ASHRAE METRICS	Status
100% Powered by Sustainable Energy	Acceptable ✓

DESIGN PLANNING & DEVELOPMENT

The most critical design requirement is to provide a temporary shelter with essential domestic systems to be used by governments and humanitarian organizations. Essential domestic systems are defined as waste management, water management, and comfort amenities. In addition to these systems, the team identified the structural and HVAC systems as critical to the success of the project.

WATER MANAGEMENT

The water management system includes a short 100-gallon potable water storage tank, a foot pump, sink, and gray water tank. The water tank is filled from a communal tap, which is common in refugee camps. The foot pump drives water from the tank to the sink, where it can be used for bathing, washing, and drinking. The sink drains to the gray water tank for collection and disposal.

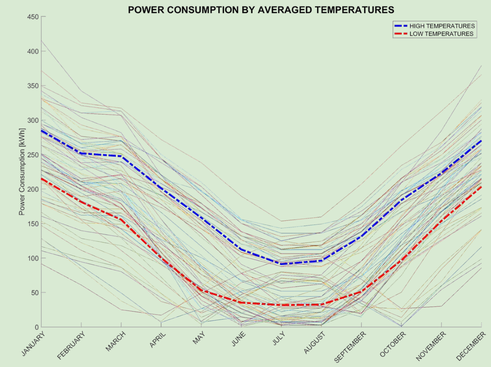


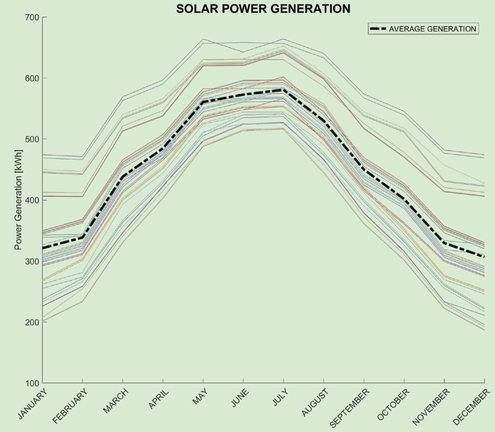
WASTE MANAGEMENT

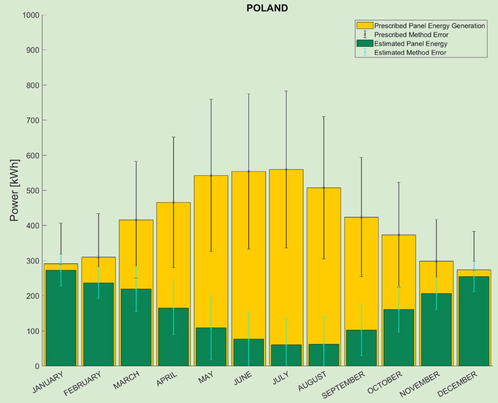
The shelter uses PeePoo bags to handle human waste. These single use, biodegradable bags keep communities clean and free of human waste. After use, the bag is tied off and buried. Two weeks later the bag breaks down and becomes useful fertilizer, enriching the soil around it.

SUSTAINABILITY

The shelter is powered through a solar energy system. By adding eight Canadian Solar Polycrystalline panels to the top of the shelter, enough power is generated to reliably power the shelter in most Eastern European locations as well as in the United States. In the absence of sunlight, the shelter can sustain itself for up to two days using zinc-air batteries in the ceiling.







CONCLUSION

This shelter provides a livable, sustainable space for refugees across Eastern Europe. With indoor lighting, climate control, waste and water management, and power generation the basic needs of a displaced family can be met in a compact, easily transported unit.